CLAIMS

1. A carbon material for forming a battery electrode, comprising carbon powder having a homogeneous structure which is produced by causing an organic compound, serving as a raw material of a polymer, to deposit onto and/or permeate into carbonaceous particles, and subsequently polymerizing the organic compound, followed by thermal treatment at a temperature of 1,800 to 3,300°C.

2. The carbon material for forming a battery electrode according to claim 1, wherein the polymerization is carried out under heating at a temperature of 100 to 500°C.

3. The carbon material for forming a battery electrode according to claim 1 or 2, wherein the organic compound is a raw material of at least one polymer selected from the group consisting of a phenol resin, a polyvinyl alcohol resin, a furan resin, a cellulose resin, a polystyrene resin, a polyimide resin, and an epoxy resin.

4. The carbon material for forming a battery electrode according to claim 3, wherein the organic compound is a raw material of a phenol resin.

5. The carbon material for forming a battery electrode according to claim 4, wherein a drying oil or a fatty acid derived therefrom is added during the course of reaction of the phenol resin raw material.

6. The carbon material for forming a battery electrode

according to claim 1 or 2, wherein a graphite crystal structure region and an amorphous structure region are distributed throughout the entirety of a particle constituting the carbon material from the surface of the particle to a center portion thereof.

7. The carbon material for forming a battery electrode according to claim 6, wherein, with respect to a transmission electron microscope bright-field image of a cross section of a thin piece obtained by cutting each of the particles constituting the carbon material for forming a battery electrode, in a selected area diffraction pattern of an arbitrarily selected 5-μm square region in the section, the area ratio of a graphite crystal structure region having a diffraction pattern formed of two or more spots to an amorphous structure region having a diffraction pattern formed of only one spot attributed to (002) plane is 99 to 30 : 1 to 70.

8. The carbon material for forming a battery electrode according to claim 1 or 2, which is produced by performing multiple times a process of causing the organic compound to deposit onto and/or permeate into the carbonaceous particles and subsequently polymerizing the organic compound, followed by thermal treatment at a temperature of 1,800 to 3,300°C.

9. The carbon material for forming a battery electrode according to claim 1 or 2, wherein the amount of the organic compound is 4 to 500 parts by mass on the basis of 100 parts by mass of the carbonaceous particles.

10. The carbon material for forming a battery electrode according to claim 9, the amount of the organic compound is 100 to 500 parts by mass on the basis of 100 parts by mass of the carbonaceous particles.

11. The carbon material for forming a battery electrode according to claim 1 or 2, which contains boron in an amount of 10 to 5,000 ppm.

12. The carbon material for forming a battery electrode according to claim 11, wherein boron or a boron compound is added after polymerization of the organic compound, followed by thermal treatment at 1,800 to 3,300°C.

13. The carbon material for forming a battery electrode according to claim 1 or 2, wherein the carbonaceous particles are natural graphite particles, particles formed of petroleum pitch coke, or particles formed of coal pitch coke.

14. The carbon material for forming a battery electrode according to claim 13, wherein the carbonaceous particles have an average particle size of 10 to 40 μm and an average roundness of 0.85 to 0.99.

15. The carbon material for forming a battery electrode according to claim 1 or 2, which contains carbon fiber having a filament diameter of 2 to 1,000 nm.

16. The carbon material for forming a battery electrode

according to claim 15, wherein at least a portion of the carbon fiber is deposited onto the surface of the carbon powder.

17. The carbon material for forming a battery electrode according to claim 15, wherein the amount of the carbon fiber is 0.01 to 20 parts by mass on the basis of 100 parts by mass of the carbonaceous particles.

18. The carbon material for forming a battery electrode according to claim 15, wherein the carbon fiber is vapor grown carbon fiber, each fiber filament of the carbon fiber having an aspect ratio of 10 to 15,000.

19. The carbon material for forming a battery electrode according to claim 18, wherein the vapor grown carbon fiber is graphitized carbon fiber which has undergone thermal treatment at 2,000°C or higher.

20. The carbon material for forming a battery electrode according to claim 18, wherein each fiber filament of the vapor grown carbon fiber includes a hollow space extending along its center axis.

21. The carbon material for forming a battery electrode according to claim 18, wherein the vapor grown carbon fiber contains branched carbon fiber filaments.

22. The carbon material for forming a battery electrode according to claim 18, wherein the vapor grown carbon fiber has, at (002) plane, an average interlayer distance

(d_{002}) of 0.344 nm or less as measured by means of X-ray diffractometry.

23. The carbon material for forming a battery electrode according to claim 1 or 2, wherein the carbon powder satisfies at least one of the following requirements (1) through (6):

(1) average roundness as measured by use of a flow particle image analyzer is 0.85 to 0.99;

(2) C_0 of (002) plane as measured through X-ray diffractometry is 0.6703 to 0.6800 nm, La (the crystallite size as measured in the a-axis orientation) is greater than 100 nm, and Lc (the crystallite size as measured in the c-axis orientation) is greater than 100 nm;

(3) BET specific surface area is 0.2 to 5 m^2/g;

(4) true density is 2.21 to 2.23 g/cm^3;

(5) laser Raman R value (the ratio of the intensity of a peak at 1,360 cm^{-1} to that of a peak at 1,580 cm^{-1} in the laser Raman spectrum) is from 0.01 to 0.9; and

(6) average particle size as measured through laser diffractometry is 10 to 40 μm.

24. A method for producing a carbon material for forming a battery electrode containing carbon powder having a homogeneous structure, comprising a step of treating carbonaceous particles with an organic compound serving as a raw material of a polymer or a solution of the organic compound, to thereby cause the organic compound to deposit onto and/or permeate into the carbonaceous particles; a step of polymerizing the organic compound; and a step of thermally treating the resultant product at a temperature

of 1,800 to 3,300°C.

25. A method for producing a carbon material for forming a battery electrode containing carbon powder having a homogeneous structure and carbon fiber, comprising a step of treating carbonaceous particles with a mixture of an organic compound serving as a raw material of a polymer and carbon fiber having a filament diameter of 2 to 1,000 nm or with a solution of the mixture, to thereby cause the organic compound to deposit onto and/or permeate into the carbonaceous particles and cause the carbon fiber to adhere to the particles; a step of polymerizing the organic compound; and a step of thermally treating the resultant product at a temperature of 1,800 to 3,300°C, wherein at least a portion of the carbon fiber is deposited onto the surface of the carbon powder.

26. An electrode paste comprising the carbon material for forming a battery electrode as recited in any of 1 through 23, and a binder.

27. An electrode comprising a molded product of the electrode paste as recited in claim 26.

28. A battery comprising the electrode as recited in claim 27.

29. A secondary battery comprising the electrode as recited in claim 27.

30. The secondary battery according to claim 29, which

comprises a non-aqueous electrolytic solution and/or a non-aqueous polymer electrolyte, wherein a non-aqueous solvent employed for the non-aqueous electrolytic solution and/or the non-aqueous polymer electrolyte contains at least one selected from the group consisting of ethylene carbonate, diethyl carbonate, dimethyl carbonate, methyl ethyl carbonate, propylene carbonate, butylene carbonate, and vinylene carbonate.

31. A fuel cell separator comprising, in an amount of 5 to 95 mass%, the carbon material for forming a battery electrode as recited in any one of claims 1 through 23.

32. A fuel cell comprising the fuel cell separator as recited in claim 31.